Remarks/Arguments

Claim Summary

Claim 1 and 3 are amended. Claim 2 is cancelled. Therefore, claims 1 and 3 - 14 are pending in the application.

Claim Rejections - 35 USC § 102(b)

Claims 1, 4-7, 9 and 14 were rejected under 35 U.S.C. 102(b) as being anticipated by Kim et al. (5,985,759).

Claim 1 has been amended to specify that the "wetting layer" is tungsten, the wetting layer is formed by a chemical vapor deposition (CVD) process or an atomic layer deposition (ALD) process, and that a metal for a barrier layer is different than the metal of the wetting layer; therefore, rendering the rejection under §102(b) moot.

Claim Rejections - 35 USC § 103(a)

Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. in view of Smith et al. (US 6,344, 281); claim 8 is rejected under §103(a) as being unpatentable over Kim et al.; and, claims 10-13 are rejected under §103(a) as being unpatentable over Kim et al. in view of Kim et al (US2002/0098682).

Referring to the 102(b) rejection of claim 1, the Examiner alleges in the "Response to Arguments" section on page 6, that "Kim ('795) teach '...forming a wetting layer of a barrier layer', wherein the barrier layer is selected from the group consisting of Ti, Ta and W (col. 9, lines 1-5)."

However, it is the Applicants' position that the Examiner has misapplied the disclosure of Kim et al. to reject the present application.

Kim et al. discloses a barrier layer structure. Column 5, line 6. Kim et al. also discloses a method of manufacturing the barrier layer structure. Column 8, lines 54 et seq. Specifically, Kim discloses a method comprising:

(a) depositing a first layer of a *barrier metal* (M);

(b) depositing a second layer of an oxygen-stuffed *barrier metal* (MO) and/or an oxygen-stuffed nitride of *barrier metal* (MNO_x);

(c) depositing a third layer of a nitride *barrier metal* (MN_x); and

(d) depositing a fourth wetting layer of a *barrier metal.*

The disclosure cited by the Examiner specifically states, "The **barrier metal** is preferably selected from the group consisting of titanium, tantalum, and tungsten." (Emphasis added.) Column 9, lines 4-5. However, this means that

the "barrier metal" of the first through fourth layers all must be titanium, tantalum, or tungsten. A combination of the metals in the layers is not contemplated by Kim et al.

Evidence for the Applicants interpretation can be found in the disclosure. Kim et al. reference defines barrier metal as **"M"**; an oxygen-stuffed barrier metal and an oxygen-stuffed nitride of barrier metal as **"MO"** and **"MNO_x"**; and a third layer of a nitride barrier metal as **"MN_x"**. By the definition given by Kim et al., the barrier metal (M) for all four layers must be the same. See example given in Table 1.

The present application discloses, and now claims, a method where the metal of the barrier metal layer is different than the metal of the wetting layer. For at least this reason, the Applicants respectfully submit that claims 1, 4-7, 9 and 14 define over Kim et al.

Claim 2 is cancelled.

Claim 3 is amended to recite that the wetting layer is deposited by an atomic layer deposition (ALD) process.

At the very least, Kim et al. and Smith at al. individually or in combination, fail to disclose a method where the metal of the barrier metal layer is different than the metal of the wetting layer, and a method where the wetting layer is deposited using an ALD process.

In addition, it would not have been obvious to combine the teachings of Kim et al. with Smith et al. In column 5, lines 10-19, of Kim et al. specifically disclose "In particular, applicants have discovered that depositing various film layers in *a particular order* using a combination of *IMP* (i.e., high density plasma sputtering, typically using a secondary energy source for ion generation within the process chamber) and *traditional sputter* deposition techniques and different process conditions for *specific layers* results in *a barrier layer structure which provides excellent barrier properties* while permitting metal/conductor filling of feature sizes of 0.5 micron and smaller without spiking." (Emphases added.) Kim et al. states clearly that their method must be followed in a precise order, using a specific deposition technique in order to achieve a specific result. Therefore, even if Smith et al. teaches forming a wetting layer of tungsten by a CVD process, there is no motivation or suggestion to combine Smith et al. with Kim et al., because Kim et al. states their method is unique.

Applicants content that claims 10 and 12 define over Kim et al. ('759) in view of Kim et al. (US2002/0098682) as argued above by the Applicants in regard to the Examiner's §102(b) and §103(a) rejections.

For at least the reasons stated above, Applicants content that claims 1 and 3- 14 define over Kim et al. ('759), Kim et al. (US2002/0098682) and Smith et al., taken individually or in combination thereof.

Conclusion

No other issues are remaining, reconsideration and favorable action upon claims 1, 3 - 14 present in the application is requested.

Respectfully submitted,

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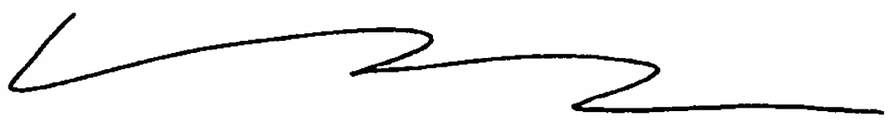

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